

# Responsible and Inclusive Citizen Science

## Comparing Initiatives and Assessing Impacts

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**Abstract:** This contribution develops from the panel titled “Responsible and inclusive citizen science: comparing initiatives and assessing impacts” organized for the VIII STS Italia Conference. We conceived our panel as a place to gather experiences and perspectives about the study and assessment of inclusiveness, effectiveness, and impact of Citizen science (CS) initiatives. A better understanding about CS, even taking into a perspective for policy-oriented interventions, may intercept crucial issues about participation and engagement into science and technology. These issues are getting increasingly explored but research about how and, moreover, what to assess as the positive outcome of CS is still in its infancy. The original idea was to build upon experience and methods to develop a common reasoning, but the discussion went beyond our expectation, elaborating the value of participation beyond the pure enlargement of the number of participants into CS activities. Accordingly, this paper explores the variety of notions of participation, citizenship, and democratization of science entailed in the idea of assessing participation and inclusion as addressed during the track.

**Keywords:** Citizen science; public engagement; impact assessment; inclusivity.

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## I. Introduction

Talking about Citizen Science (CS) often refers to non-experts that volunteer into data collection. Supporters of CS are largely confronted with the issues of reliability of CS-generated data produced with techniques and methodologies that encourage and sustain ongoing participation necessary for a project's realization.

Current debate about CS is increasingly engaging with the issue of the assessment integrating it to the array of challenges that are already on the table (e.g. quality of scientific activities – Vohland et al. 2021). Since assessment is the issue of defining tools for measuring and giving account of the impact of a certain activity, its presence is the signal of a mature contribution into the debate (Wehn et al. 2021). Indeed, assessment for CS aims to go beyond pure speculation about the claims for effective public engagement. Already in 2016, the Crowdsourcing and Citizen Science Act (CCSA) intended to “encourage and increase the use of crowdsourcing and citizen science methods within the Federal Government to advance and accelerate scientific research (...)” (US House of Representatives 2016).

Moving from such praise for offering valuable contributions to knowledge creation, focusing on the assessment is about to become a specific and urgent necessity, not only in the US but to the whole CS community. Indeed, the Ninth European Framework Programme, labelled Horizon Europe, clearly indicates for applicants to address societal needs and suggests considering different approaches to public engagement; plus, there is an explicit mention to Citizen Science. In doing so, the European Commission embraces the current success of such a catchy label; indeed, the participation into scientific activities by non-experts is one of the main features of CS. Being considered as a brand-new opportunity for public engagement, supported by the diffusion of Information Communication Technologies (Wynn 2017; Haklay 2015), as well as an established tradition in environmental monitoring (Bonney et al. 2016), the general tone of the debate around CS agrees in its great potential. As such, the growing community of scholars, practitioners and theorists that supports CS actively started interrogating themselves about the tools and strategy to effectively assess it.

The thematic session we proposed to the VIII STS Italia conference titled “Responsible and inclusive citizen science: comparing initiatives and assessing impacts”, addressed exactly those issues in order to bring forward the discussion and complementing it with an alternative perspective, which can enrich the debate about the relationship between science and society. With this short resume the aim is to explore the variety of notions of participation, citizenship, and democratization of science entailed in the idea of assessing participation and inclusion: this is the challenge we addressed as convenors for our track. The present paper gives account of the main topics emerged during the session that further complexified the topic of assessment, reconfiguring the issues of inclusiveness, engagement and the

political value of CS. Before going through them, we will first summarize the main promises of CS for engagement, by accounting for the themes emerged during the debate and listing the main issues connected to the urgency of assessment.

## **2. Setting up the Scene: Citizen Science and its Promises for Public Engagement**

There is not a unique CS definition (Haklay et al. 2021). There is a wide array of practices that can be listed as CS and at the same time, CS as a topic is open to a heterogeneity of practices characterised by several levels of engagement aligned with participatory research. To give some general coordinates, many agree on the idea that Citizen Science consists in some kind of activity oriented to data collection supporting professional scientists in their research (Bonney et al. 2009); other scholars look at Citizen Science as an attempt to enter the agenda of science policy typically retained as dominated by a logic other than one of citizenry (Irwin 1995). These two sides of CS are particularly famous (Kulleberg and Kasperowski 2016) and co-exist in the debate; they are rarely considered as opposed perspectives, rather they are literally interpreted as two sides of the same coin (Cooper and Lewenstein 2016). Indeed, as recently reported (Strasser et al. 2019), CS has the potential to fruitfully address the rhetoric of openness and democratization of science in a threefold way: first, CS is presented as a trigger to foster public engagement in order to make knowledge creation process more open towards societal needs, in coherence with a dialogical approach between scientific institutions and society at large; second, even though not all CS activities have primarily an educational goal, many theorists and practitioners promote it as a way to foster scientific literacy for those who have been engaged in activities within a specific CS project; third, by being engaged into some kind of scientific activity, a volunteer would also learn about the scientific method as well as critical thinking and should be consequently more positively oriented towards science as an institution. The second and the third promises derive from the democratization thesis, which should be “more politically palatable than the previous autocratic or dictatorial regime of science” (Mirowski 2018, p. 177). The potential gains of CS for knowledge production and scientific literacy have been positively assessed when directly analysed in specific contexts (Bonney et al. 2016). However, knowledge improvements about certain topics do not necessarily demonstrate a more democratic turn; Martin (2017), in her analysis about the composition of volunteers in a CS project in Australia, for instance, questioned the presumption of CS as a tool to enrol people that are not already “engaged” with science; indeed, in that case volunteers’ average profile tends to be a highly educated one and thus easily stands out in some scientific subjects. For this reason, the opportunity to provide insights for marginalised or normally excluded groups is

not guaranteed. CS per se does not avoid typical barriers in engagement and this should not be overlooked. The same applies to increasing scientific literacy: not all the projects include it as an aim (Bonney et al. 2016) and are mainly concentrating efforts in coordinating volunteers for data collection (Hecker et al. 2018); furthermore, even though the increase in scientific literacy can be declared as a main objective, CS projects are not equipped for assessing its long-term effects. Finally, the fact that we can apply technologies and methods to support participation (Newman et al 2012; Wynn 2017), it does not automatically imply a contribution into the democratization of science (Felt and Fochler 2010).

Here we convey that it clearly emerges the need to address the different facets of assessing CS projects.

### **3. Elaborating Issues of Impact Assessment**

Research about how to effectively assess CS is still in its infancy. As reported by Wehn et al. (2021), even though there are some reflections linked to single projects' perspectives, the literature is quite sparse and vast. Indeed, it should be acknowledged that talking about impact assessment may embrace several areas of interest that require methods for a comprehensive oriented data collection approach (Giardullo et al 2021).

Being this said, there is wide room for reflection about CS features especially concerning inclusiveness, effectiveness and impact of CS initiatives. Our track aimed exactly at taking stock of experiences about the sub-themes related to CS impact assessment, such as: measuring and comparing inclusiveness across initiatives; defining useful criteria for the selection of both qualitative and quantitative indicators; tracking specific connections with the Responsible Research and Innovation (RRI) pillars and, relatedly, how to address gender balance within these initiatives. The discussion involved experiences or research about CS activities, and an audience that actively participated in the conversation further expanding the scope as convenors we originally imagined. A key element that emerged almost immediately is the repurposing of the two coexisting sides of CS: fully funded top-down projects and the grassroots ones. These two perspectives did not come out of the blue but rather represented the research topics provided by the session participants: a combination of research experiences about engagement into the analysis of CS, both from the perspective of institutional projects and from self-organized communities that promote local and sometimes trans-local mobilization, especially in the case of environmental conflicts. Such a state of affairs echoes issues related to the engagement of indigenous into data collection campaigns in those areas so important for biodiversity and climate change in Global South areas. Often promoted by researchers from universities coming from Global North these research programme may encourage participation of communities

traditionally excluded from scientific research, nonetheless it is uncertain if it can actually drive to a more open way of producing scientific knowledge and empower people. The risk of reproducing bias and power asymmetries is likely if researchers do not deal with them directly (Young and Gilmore 2017).

The conversation during the session allowed us to consider exactly the ambivalent role of inclusivity of CS in a complementary way.

On the one hand, both research experiences by CS projects and analysis provided by scholars from a top-down perspective approached the assessment of tools for engagement: how they work and how they do so, for instance checking the profile and composition of volunteers. Therefore, the efforts aim at understanding whether strategies to create opportunities for enlarging the array of people involved into the creation of scientific knowledge are working. Indeed, many of the issues that emerged reflected gender segregation, education and social class inequalities that are well-known for science. The suggestion to concentrate on the outcomes, meaning on the gains obtained or missed, compared to the aims of the project, rather than on outputs, is shared by most participants as a necessity in order to synthesize what a CS project can obtain.

On the other hand, analysis of grassroots projects, made visible to participants how inclusion is a debatable issue. Indeed, for example, grassroots projects that react by collecting data as evidence of an environmental emergency affecting their lives, may do so in contrast or as an addition to official environmental monitoring agencies. In this sense, these self-organized groups for data collection cannot be inclusive: first, because they typically start activities in response to a fallacy in the official data, which they either do not longer trust or do not consider reliable; second, because, especially in local environmental conflicts, being inclusive may enlarge too much the spectrum of their protest, exposing them to the risk of not being able to manage proficiently their efforts.

Therefore, inclusiveness turned to be a matter of concern in an unexpected way for a European/Global North context. It further reflects the two coexisting sides of CS but, in a sense, it complexifies the whole concept of inclusiveness itself. The narrative of being quantitatively inclusive and diverse in the context of top-down CS projects shows only a facet of the story. Indeed, as we learned through the confrontation and the debate with the participants of our session, inclusiveness cannot be taken for granted as a topic with an univocal value. Different experiences that may fall under the label of Citizen Science may interpret differently the issue of inclusive participation into their activities.

## 4. Conclusion

As the reader should have noticed by going through our contents' resume for the "Responsible and inclusive citizen science: comparing initiatives and assessing impacts" session, organized for the last STS Italia Conference, we went well beyond our expectations. Indeed, the debate triggered by the contributions of the participants and audience overcame the more technical and methodological issues. The many facets of impact assessment for Citizen Science once put on the table promoted a valuable discussion that provided an alternative perspective on inclusiveness and participation: the two dimensions typically assumed as desirable outcomes for a CS project. However, the discussion provided a twist to the concept driving to a more thorough analysis. Certainly, by deconstructing those concepts, the discussion provided interesting theoretical elements based on the collective re-elaboration of the empirical experiences brought by the participants.

Therefore, if CS cannot be taken for granted as a coherent phenomenon for the engagement of non-experts that take part into some kind of scientific research activities, the same applies to inclusiveness and participation. Potentially, an access into the governance of environmental issues (the main domain amongst the many presentations) as well as into policy for research can be obtained by CS projects that are not inclusive. Rather than being exactly the opposite, grassroots projects may be able to gain visibility into a political debate much more than welcoming forces from the institutions or from other groups. Such a perspective on inclusiveness is intriguing. While promoters of the mainstream narrative of CS as a method insist on the opportunities to enlarge participation and to promote engagement of non-experts, grassroots experiences, even though not always successful at this, configure the notion of inclusiveness in a more blurred way. Almost paradoxically, the highest aspiration of CS labelled as the "democratization thesis", supports a more political value of inclusion fulfilling the principle of participatory turn into science policy (Strasser and Haklay 2018). However, quoting again Mirowski (2018), such a democratization may be obtained precisely without following the idea of inclusiveness in a blind fold way. The inclusion of a wider and wider array of social actors into such processes is at the core of many funding schemes. Indeed, most publicly funded projects for technoscientific innovation expressly require strategies of public engagement. However, our panel deconstructed such an idea, pushing on the table of impact assessment of CS projects an interesting research question: in order to be politically sounding do we need to be necessarily inclusive?

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